To Members of Congress:

The promoters of the Tehuantepec Ship Railway have insisted upon the presentation to Congress of a bill containing a provision for a subsidy to that enterprise.

Should such a bill pass it will entirely prevent the Nicaragua Canal Company from securing capital, as no private enterprise can compete with the United States in such an undertaking.

As the canal is perfectly feasible, and involves no features of experimental trials or doubtful mechanical contrivances, it can hardly be to the interest of the country to expend money from its treasury in a very questionable venture at a time when it will thereby arrest a practicable and highly important work. The French Company is fairly launched, and an attempt to construct an effective ship railway will not in the slightest degree avert the operations of that company, the railway scheme not commanding sufficient respect.

Should Congress charter both the Tehuantepec and Nicaragua companies without subsidy, leaving them to find capital as they may, the result will not be doubtful, except possibly as between the Nicaragua canal scheme and the Panama one, for which a large amount has already been subscribed, giving to it a great advantage.

Very respectfully,

S. L. PHELPS.

WASHINGTON, D. C.,
February 8, 1881.

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The topographical features of the Isthmus of Tehuantepec will determine many of the difficulties to be overcome in constructing and operating a ship railway.

General Barnard's surveys for an ordinary railway across it, and those of Commodore Shufeldt for a ship canal, in both of which surveys every pass was subjected to examination, show that the highlands between the two oceans, where practicable lines for either undertaking were found, are only about 19 miles in width, and that the elevation to be overcome is 754 feet, while the air-line distance across the Isthmus at that place is 143.5 miles.

The passages from the elevated plains to the Pacific are through narrow gaps in ranges of hills, showing rugged limestone peaks of 1,500 to 2,000 feet altitude, and the descent is abrupt to the Pacific plains, which are about 20 miles in width and from 70 to 230 feet in elevation. It is then about 100 miles from the mouth of the Coatzacoalcos River, along the line of their surveys, to the mountain ranges. In this distance the railway and canal lines are in the broad alluvions and valley of that river.

General Barnard's ascending grades from the Gulf of Mexico involve 60 feet per mile, with sharp curves, deep cuts, heavy fills, and tunnels. In the descent to the Pacific he followed tortuous mountain streams to obtain a grade of 55 feet per mile in a running distance of 10 miles, the distance gained in a right line being about 5 miles. The canal descent found most practicable was through a different gap and on a large curve, with grades of 80 feet per mile in a distance of 8 miles.

The profiles of these gaps show grades of from 113 to 150 feet per mile.

Under such conditions, what would the construction and operation of a ship railway involve?

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The first inquiry is, what ships are to be transported? Clearly, the heaviest vessels in use anywhere. Such ships will be employed in the long voyages between ports of the Atlantic and of the Pacific, and such are now employed between California and China.

Weights to be Carried.

The displacement of a number of steamships in service indicate weights of ship and cargo reaching from 9,000 to 12,000 tons, their length being from 450 to 500 feet and upwards. Hence ability to carry a ship and cargo weighing 12,000 tons is necessary. Without it the railway will be a failure.

The dock to lift such a weight to the level of the railway track must raise the ship, and the car, cradles, and supports to carry the ship, or, in all, say 24,000 tons. The model of the ship must be known, that cradles and supports can be made in advance to accurately fit her form, so as to secure perfect support throughout the vessel's length. No two ships have the same form, and cradles must be fitted for each vessel carried. These cradles and supports must be immensely strong to sustain a ship towering 50 feet above the car—higher than her width,—and loaded with a heavy cargo.

Plan of Railway.

Captain Eads' plan is to have 6 tracks; that is, 12 rails. Allowing 5 tons pressure upon each wheel under the ship car, there would be required 4,800 wheels. These placed at 3 feet, centre to centre, would require 14,400 feet of rails, or 28 rails of 500 feet in length, or $2\frac{1}{3}$ times more than Captain Eads adopts; and the rails, if under the ship, would hardly be 20 inches apart! But the central portions, where the weight of the ship is greatest, would require the wheels to be placed in greater proportionate number; hence still more

rails would be necessary. The pressure for a given area would be at least four times greater than that from any locomotive in use.

There is yet another cause of difficulty. When in motion the ship would practically rest upon four points. When cars have 4 wheels, the weight is equally distributed over them; add 2 wheels, and 4 of the 6 will still carry the load, but the weight will be transferred momentarily according to deviations in the plane passed over. This source of disaster from over-loaded wheels would be a constant danger.

Equivalents.

The weight to be transported is equivalent in amount to the weight of over 1,200 freight cars and their loads. Such a train would extend 8 miles along a railway track, and, on gradients not exceeding 40 feet per mile, would require 60 locomotives. For such grades as would be necessary across the Isthmus many more engines would be required.

Changes in Gradients.

The ship in view is one-tenth of a mile in length. A change in the inclination of the road-bed from the horizontal to grades of 10, 20, 50, or more feet in a mile would suspend this vessel by the ends while entering upon the new gradient. At one point the ship's middle portion would be, in such changes, from 6 inches to $2\frac{1}{2}$ feet, and so on, above the level of the platform car, and would not therefore rest in the cradles at all. A failure to so rest upon them by one inch in the case of a loaded ship would be destruction to fastenings. It is possible springs might be resorted to where there are 3 or 4 inches of difference in level, and thus a ship might in running a great distance, be gradually got to an inclination of fifty feet or more per mile. But the earth's surface there admits of no such method. The profiles, as

already stated, show an abrupt character of ascents and descents.

In General Barnard's railway route, where traversing the elevated section from the Jaltepec river to the Pacific plains, and involving an ascent on the one side of 437 feet and a descent on the other of 593 feet, the ascents and descents were, respectively, 1,346 feet and 1,221 feet, exhibiting an uneven surface in the elevated land.

A ship railway must be absolutely straight, and tunnels are out of the question. It is proposed to change direction by use of *turn-tables*. These must be horizontal, and will not avail in overcoming sharp ascents or descents. If a ship can be hauled up gradients of 115 to 150 feet per mile, then the elevations can be surmounted, provided the ship can first be changed sufficiently in inclination to the horizontal. This change in inclination would become necessary many times in the distance across the Isthmus.

Tilting-tables have been suggested. These must be 500 feet long, and must carry, with a pivoting centre, 24,000 tons besides their own weight, which would be probably as much more. Such a structure, weighing, with its load, 48,000 tons, would be a prodigious thing to manage. Think of over one hundred millions of pounds!

Change in Direction.

This would be frequently necessary in that mountain country and can only be effected by use of *turn-tables*, which must be 500 feet or more in diameter, and must carry 24,000 tons and their own weight, which would probably approximate to the weight carried, or say another 24,000 tons, and the whole weight would again be 48,000 tons, more or less. The wheels of a loaded freight car, by including the weight of car, trucks, and wheels, are subjected to a pressure of about $2\frac{1}{2}$ tons each. If the wheels of the turn-table are supposed to take twice as much, that is, 5 tons

pressure each, 9,600 wheels would be required for each one, reduced in number by whatever proportion of the weight is carried upon the pintal.

Meeting Ships.

What is said of turn-tables can also be said as to *sidings* to enable meeting ships to pass. Similar weights are to be moved, and upon a like number of wheels. There must also be an extra track to run in for the passing ship to take. Turn-tables might also be resorted to for this purpose.

It will be seen that these devices involve incredible weights, a vast number of wheels, and very costly constructions. In a distance of 160 to 180 miles there must be several sidings for passing ships and many "turn-tables," besides frequent tilting-tables for changing the inclination of the ship to the horizontal.

Ships in Storms.

A ship in the water is, for its strength, the lightest of structures, while out of the water it is the heaviest of structures for its strength. Resting in water, the ship is sustained by a medium entirely surrounding the bottom and pressing in *equal force* upon every inch of its surface. In a gale of wind the ship offers to the blows and force of seas a curved or sèmi-cylindrical form, fortified by interior knees, frames, beams, and decks. Floating in a fluid, the vast mass yields to seas by easy movements which involve no injury, because, whether rolling or pitching, the support from the water is uniform at all times and at all points. There is no inequality of pressure from the supporting water. The ship, whatever its momentary position, is sustained in the direction of its gravity equally in all the submerged portion, which, in effect, is always the same in amount. When waves toss the ship about, it becomes a falling body received upon a *water cushion*, so to speak, which presses and

yields everywhere in exactly the same degree; hence there is little or no strain in a well-constructed ship when the weight carried is evenly distributed, as seamen take care it shall be. Moreover, there is comparatively little motion in the bottom of the vessel, whatever there may be 30, 40, or 50 feet above it, because motions at sea are from the bottom as the centre. Ships often spring leaks at sea, but those are weak or defective in construction, in bad repair, or badly loaded. When staunch vessels meet with disaster, it is usually through the weight of seas falling upon the decks, or force of blows that open seams—not often from longitudinal strains.

Taken out of water and placed upon a platform, the feature of being equally sustained is lost. While at rest there will be strains, because the ship is a rigid structure resting upon a rigid support, which cannot be maintained as a perfect plane, nor can the ship cradles be so shaped and placed under the ship that all will receive the same degree of pressure at all points from the weight carried. Any defect in this respect causes strains upon rivets and bolts in the effort of the supported mass to conform to the supports. If to the weight of the hull is added the pressure of thousands of tons of cargo, the force exerted to destroy fastenings is greatly increased.

Now, place this ship and platform on wheels, and these upon iron rails subjected, in a length of 500 feet, to the pressure of 24,000 tons weight, the whole carried alternately on earth in cuts and fillings exposed to the action of enormous rain-falls, can one doubt that serious inequalities will be met in every section passed over which will subject the hull to severe strains? The exterior will not show the extent of damage hidden beneath the cargo—damage that will be left to be developed in the first gale encountered.

The hull would tower 50 feet above the platform, while above all still would be masts and yards. The cargo inside, 30

or 40 feet deep, with its vast weight acting outwardly on the weak bottom and sides—weak in construction as against interior pressure, and weak out of water because insufficiently supported—would be a potent power for destruction. It becomes a wedge of vast splitting force, increased in its effect by the vibrations transmitted to the mass when in motion over the rails.

A Ship on Cars in a Gale of Wind.

The north winds spring up suddenly and frequently at certain seasons, sweeping across the Isthmus of Tehuantepec with great violence, and often are of long duration. Sea captains in passing the Gulf of Tehuantepec keep close under the shore to avoid the heavy sea due to these high winds. The ship, in the highlands especially, would present a hull 50 feet high and 500 feet long to the action of these winds, a surface of 25,000 square feet, besides yards, masts, boats, chimneys, &c. The great wind-force of these gales—12 to 25 pounds or more per square foot—would act upon the side of the car from the wind with a *great leverage* and with an irresistible power for destruction to supports, cradles, and wheels. Ordinary cars, indeed, whole trains, have been blown from tracks in winds no more violent than those at Tehuantepec. Storms always create grave apprehension for ships in dock.

General Considerations.

The distance saved for steamers by way of Tehuantepec between the Atlantic and Pacific ports of our country would be only 510 miles, as compared with the distance *via* the Nicaragua Canal route, and much of this advantage would be lost in the outward voyages in steaming against the Gulf stream. For sailing craft in outward voyages the Tehuantepec route is farther than *via* Nicaragua. Between our Gulf ports and the Pacific States the distance

via the Canal would be considerably greater, but those are mainly ports of exportation. The future carrying trade between the Atlantic and Pacific ports of the Untited States will, in the westerly voyages, consist mostly of manufactured goods and coal. In the easterly voyages freights will be largely exports. Our great interests are therefore between ports favored in small degree in distance *via* Tehuantepec. That route is also a more remote one from all our Atlantic ports to the entire west coasts of Central and South America, where we have an important and growing trade. The Gulf about the mouth of the Coatzacoalcos is a dangerous locality for sailing craft in the norther season, when they would be on a lee shore. The great ship-canal in Holland has locks 23 feet deep, yet 681 vessels of all classes have passed them in 24 hours. How many sidings and locomotives and ship-cars would such a trade across Tehuantepec involve?

One lock is as much a measure of the capacity of a canal as are 12 locks. What can be done in the Holland Canal can be done in the Nicaragua Canal. Why resort to an experiment of such doubtful character and so vastly expensive as a ship railway when a cheap, safe, and desirable ship canal route offers? Builders, owners, seamen, and underwriters all condemn the railway plan as impracticable, if for no other reason than that ships cannot be taken out of water safely with cargo on board. The canal can be operated and maintained at an expense amounting to less than $1,000,000 per annum The Suez Canal, 100 miles long, costs $800,000 yearly. The Nicaragua Canal proper is 53.17 miles long. The railway expenses will be at least 60 per cent. of its gross receipts, and probably much more. This great difference in cost will be a direct tax upon shipping and upon our coast trade. In other words, such tolls as would pay a handsome return upon the capital invested in the Nicaragua Canal would hardly pay the run-

ning expenses of a ship railway, even supposing one a possible and practicable undertaking, which it is not.

Estimated Cost.

The estimated cost of the canal is $41,000,000; that of the railway, *for which no surveys have been made*, is $75,000,000. Doubling these estimates to cover all kind of contingencies will make the canal cost $82,000,000 and the railway $150,000,000. As projected, the railway scheme involves about as much canal as the Nicaragua route, and will have *two locks*.

Ten millions of dollars gross receipts for the Nicaragua Canal would, after allowing $1,000,000 for all expenses, net $9,000,000, or near 11 per cent. upon outlay. It should be remembered that 120 of the 173 miles across Nicaragua would be wide river or lake navigation, involving no kind of expense, except for towage of sailing vessels. A great increase in canal business would but slightly increase its expenses, and that only for towage.

Ten millions gross receipts for the railway would, after deducting 60 per cent. for expenses, leave $4,000,000 net, or $2\frac{2}{3}$ per cent. on outlay. The average expenses of railways bear a larger ratio to receipts than 60 per cent., and it cannot be doubted that, if in any degree practicable, the ship-railway would be enormously expensive in proportion to gross receipts.

This difference in the cost of operating the canal and railway will become a direct tax upon the industries of our country and the products of the Pacific States, and upon our commerce, for half of the business of the transit will be American. The United States are asked to fasten this needless tax on the country, and to do it by putting up a vast sum of money to try an experiment for which a favorable result cannot be anticipated.

Welland Canal.

The Welland & St. Lawrence Canal system has a total length of 71 miles and overcomes an elevation of 549 feet. It has been in operation many years, but is now being enlarged to admit the passage of vessels of 2,500 tons burden from the Atlantic Ocean to Lake Superior. The enlargement will be completed in readiness for the coming wheat crop, and the whole cost will then have been about $52,000,000.

APPENDIX.

Capacity of some dry-docks and marine railways in the United States:

Railways.

Baltimore	capacity	1,500 tons
Fair Haven, Conn	"	450 "
Hunter's Point	"	1,600 "
New London, Conn	"	500 "
Norfolk	"	1,500 "
Wilmington, Del	"	800 "
Wilmington, N. C.	"	900 "

Balance Docks.

Mobile, Ala	capacity	3,000 tons
New York	"	8,000 "

Sectional Docks.

Jersey City	capacity	1,800 tons
Philadelphia	"	2,000 "
Mare Island, Cal	"	5,300 "

Dry-Docks.

Brooklyn and Charlestown	capacity, each	7,000 tons
Norfolk	capacity	7,000 "
Porland, Me	"	8,000 "

It will be seen that railways to take vessels out are for comparatively small craft. The largest found in a table of docks is the one at Hunter's Point. Where heavier ships are to be handled other docks appear to be preferred as more safe or practicable. Yet none of the dangers arising from a carriage overland offer in a marine railway. It is as perfect *an incline* as can be constructed and upon foundations built at an expense and with a degree of care quite impracticable in a long ship railway, while the steam power is stationary and the movement in taking ships out extremely slow.

The grant for a ship railway across Tehuantepec has not been confirmed by the Mexican Congress and is not valid until confirmed. Some of its features are given in these extracts from the—

New York Times, Feb'y 3.

Article 17 forbids the company to exercise any power or privileges in relation to the issue of bonds or other guarantees that may be in conflict with the provisions of the laws of Mexico, and the second section of article 25 specifically provides that for granting to the United States those concessions which Capt. Eads has proposed in his bill, the Mexican grant shall be null and void. The section alluded to prescribes, in distinct terms, that for alienating, transferring, or mortgaging this concession or

the rights derived from it, to any foreign State or Government, or for admitting it as a partner, the concession made by Mexico shall be void. Under this section a contract such as Capt. Eads proposes with the United States would make his grant from Mexico absolutely worthless. In order to enforce the abrogation of the concession as provided by article 25, it is provided in the succeeding article of the concession that "if the voidance should have been caused by alienation, mortgage, or transfer to a foreign government, or because of its becoming a partner, in addition to the working of the nullity of the act or the voidance of the present contract, the Nation shall enter at once into possession of the control of the road, its accessories and lands, without the company having the right of indemnification of any kind."

That the Mexican Government in making the concession to Capt. Eads determined to maintain absolute control of the proposed railway is shown by article 28, which reads as follows: "The company shall be Mexican, even though some or all of its shareholders be foreigners, and shall be subject exclusively to the jurisdiction of the tribunals of the Republic in all matters of which the cause of action may take place within its territory. The company itself, as well as all foreigners and their successors taking part in the enterprise, whether as shareholders, employés, or in any character whatsoever, shall be considered as Mexicans in all things relating to the company; nor can they even allege with regard to title to property and other matters connected with the company, rights as foreigners under any pretext whatsoever. They shall have those rights and the means of making them valid which the laws of the Republic confer on Mexicans, and consequently not subject to interference on the part of foreign diplomatic agents." It will thus be seen, by the very terms of the concession made by the Mexican Government, that Capt. Eads is asking the United States to contribute money for an enterprise which, when completed, would be entirely under the control of the Mexican Government, and which could not only be used by that Government against the United States in the event of war between the two countries, but which would become the property absolutely, of Mexico, by reason of the very contribution which Capt. Eads is soliciting from this Government.

Opinions of Shipbuilders in Relation to Hauling up or Docking Ships Having Cargoes.

"I am in receipt of your communication, and in reply I have to say that in my opinion a ship or steamer of large dimensions cannot in safety be taken out of the water with cargo on board, as there would be great danger of injury to the hull, and consequently cannot be safely transported with cargo on a ship railway.

"Very respectfully,

"JOHN ROACH."

Wm. H. Webb, Esq., the celebrated shipbuilder, concurs in this opinion.

The Harlan & Hollinsworth Company, of Wilmington, Delaware, say: "If the foundations of the railroad, having six tracks, could be made *substantial, so as not to yield* under the immense weight of a loaded ship, we believe that a cradle could be constructed to receive the ship and transport it the distance named without injury. But to do so the ship would have to be constructed specially for such service, having such peculiarity of construction as would permit such handling without fear of injury. The ordinary wooden vessel of to-day would hardly venture upon such a journey overland; neither would underwriters take the risk of damage unless vessels were prepared for such service.

* * * * * * * *

"We have read very carefully the letters written by Admiral Ammen to Mr. King. We think he has left very little to be said hereafter, as he has covered the ground fully."

The Pusey & Jones Company, of Wilmington, Delaware, say: "So far as relates to injury resulting to the vessel itself from being raised from the water while loaded opinions will differ. A new, strongly-built *iron* ship might endure this without damage, but in our opinion the element of danger of sustaining serious damage while being transported under such condition would be regarded by the average ships owner as a risk which he would not be warranted in taking, and we are further of opinion that underwriters would share the shipowner's views.

"In so far as the element of danger of sustaining damage relates to wooden ships, or iron ones whose plates have become thinned by age, the carriage proposed would be simply destruction.

"However well a ship might stand the strain of being quietly docked with a heavy cargo on board, the fact could hardly be used as an argument that she could be safely transported while so raised from the water; the dynamic effect of the load and of the boilers and machinery would be an element of danger that only extraordinarily strongly built ships could resist, and very probably even these would not."

"As to the uniform solidity of the road-bed necessary to safety of transportation, we are of opinion that in a country so subject to heavy falls of rain as is that of the one on which it is proposed to make the road the problem presented is so difficult as to be scarcely capable of solution."

"Finally, we think the whole question of a ship-railway, as proposed, is so full of grave and scarcely surmountable difficulties that it is scarcely worth consideration."

T. F. Rowland, Esq., Continental Works, N. Y., says: "I have some crude notions as to the best method of moving large and heavy bodies, and feel certain that 'carriage on wheels' cannot be so classified. Although it may be theoretically possible to equally distribute the weight of a moving body upon any desired number of supports, practically it is almost a mechanical impossibility to do so. A four-wheeled vehicle will equally load each, but if another pair of wheels are added they will carry the whole load or no part of it, as the road varies more or less from a perfect plane. In cars and locomotives eight wheels in place of four are desirable, but experience has proved they must be grouped in trucks or harnessed with springs, equalizing bars, or other devices in order that in effect the load must rest upon *four* points only. The car and locomotive are strong enough for this treatment, but not so the ship, whose shape, strength, and general make-up demand conditions of support which can best be obtained by being water-borne, and cannot otherwise without more or less injury to the structure. So it happens when it becomes necessary to dry-dock or haul a ship great judgment, care, and labor are demanded to know when and how to tighten or loosen the supports and to perform the operation without seriously injuring the vessel; so much so is this the case I think it may be safely assumed that few vessels are dry-docked without sustaining more or less permanent injury."

The Atlantic Works of Boston say: "Our positive ignorance of this matter throughout forbids our expressing any opinion at length. It does not seem to us a feasible plan, and we do not believe it will ever be accomplished. Were it not that Capt. Eads has already 'done wonderful things,' we should not hesitate to declare this scheme *impossible* of execution."

The above expressions of opinion comprise those of all the firms in our country, except one, which construct large iron ships.

Opinion of Civil Engineers.

The Honorable John Conness, formerly of the United States Senate, has forwarded the following expression of opinion of an able civil engineer in whom he has great confidence: "Admiral Ammen's testimony before the select committee, as given in the slips sent me, tells the whole story, and puts Eads' absurd project in its right light. * * * The first thing that must strike any one acquainted with shipping is the utter impossibility of transporting a loaded ship of even 1,000 tons capacity, as ships are now constructed, any considerable distance on a railway with safety. I know something of ship construction, have built and operated marine railways, and I have no hesitation in saying that I do not believe one ship in ten of our present commercial marine, loaded, can be hauled up with *perfect safety*, out of water, on any of our most complete marine railways. It is considered dangerous to allow a loaded vessel to take bottom under the most favorable circumstances. In one word, before Eads' railway (if built) could be used, we would have to build ships expressly for it. Now, supposing the railway built, and the ships for it, the real difficulties have just begun. What sort of a car or cradle will he place his ship in? Will it move on wheels or rollers? If on rollers, how will he attain any speed; and if on wheels, how many will his car need to carry a weight of from 3,000 to 5,000 tons? A common freight-car needs eight wheels to carry ten tons. The motive power must be from stationary engines."

Wm. J. McAlpine, Esq., second to no civil engineer in this country, wrote that he regarded the Eads scheme quite as visionary as M. de Lesseps' canal at the ocean level, and that he would discuss the subject without delay. Since that time, illness has confined him to his bed, and so far delayed his expressed intention. His opinion

has special value, as he has full professional knowledge of the ground, having recently spent months examining and locating the best lines for railway between the oceans.

Regarding Insurance.

J. Parker, Esq., of New York, writes as follows: "In all my experience during the last fifteen years as an underwriter's surveyor, and in my present capacity as a manager of a book of classification, I have never known a vessel to be docked with her cargo in, except for the purpose of raising her slightly in order to reach a leak a little under water. No dock-master would consent to raise a vessel laden with the cargoes that are likely to be sent hence to San Francisco, or thence through a ship-canal, through a railway over the Isthmus of Darien, or Captain Eads' proposed route; and I am very decidedly of the opinion that no vessel so laden could safely be taken across such a railway, and then sent upon an ocean voyage. Certainly she could not be, unless a new style of naval construction were first adopted.

"As to the general subject, I suppose that, in the face of the experience of the Suez Canal, and the vast saving of time and distance worked out by that, no one can doubt that a ship-canal through the Isthmus, or Nicaragua, would be a vast benefit in every way to the commerce of this country, and to the Nations generally. I do not believe it would revive our commerce, or, rather, our mercantile marine; that will never be revived until the burdens it has to bear, from which the marine of all other nations are exempt, are taken off, but it will of course give additional advantages to the few vessels that now fly our flag, and are confined to the coasting trade.

"Yours very truly,

"J. PARKER, *Secretary.*"

Opinion of C. H. Mallory, Esq., a former shipbuilder, ship captain, and now a large ship-owner:

"Your favor of the 20th, asking for an expression of our opinion of the practicability of transporting loaded ships over a railroad one hundred miles 'without being water-borne' is received. * * * We have given some thought to this matter, and have believed it impossible to transport a loaded ship over miles of railroad in a cradle without being water-borne without great damage to the ship.

"It is considered highly dangerous to take a loaded ship out of water on one of our sectional or balance-docks, and it is the rule, and is required by underwriters in most instances, that the cargo in whole or part shall be discharged. It appears to me that an iron ship, loaded with heavy cargo, transported on a railroad over one hundred miles (however smooth) without being water-borne or some equivalent, would be very apt to require an entire new fastening of rivets before launching again."

Opinion of the Officer Who Transported the Obelisk.

Lieut.-Com'r Gorringe says: "However successful Captain Eads may be in moving a laden ship across such a distance over such varying grades, the ship would not float on reaching the point where the floating would be a matter of some importance. * * * The jarring in motion, no less than the development of strains not provided for in ship construction, must inevitably open every seam and cause every rivet to leak."

In asking for and presenting information, it is worth while to state that nothing has been suppressed from a divergence or difference of opinion, which might be supposed to be the case from the unanimity or concordance of the above opinions.

Eads' Plan—Practical Views on the Proposed Isthmus Railway.

PHILADELPHIA, *January* 28, 1881.

To the Editor:

I notice that Captain Eads has made a proposition to build a ship-railway across the Isthmus, to carry ships loaded with their cargoes, and I beg herewith to say, as a practical ship-builder, that such a proposition is nothing more than a delusion upon our people. I have built over one hundred ships, some of them the largest sailing-ships in the world, and it is with the greatest care that all ship-builders are compelled to lay the keels and see that the foundations for the launching-ways have the very best possible bearing that can be devised, so that the vessel can be launched with safety, without injury to the hull, when sliding a distance of only one and one-half times its own length.

I also notice that our Government has been asked, and it is thought that it will endorse the measure by guaranteeing some $50,000,000. Before any enormous expenditures are made it would be well to pause and consider what we are to receive for our money after the work is done, and what are the benefits arising from it. Is the scheme a practical or a theoretical one? Speaking for myself—and I claim to speak from a practical stand-point, backed by years of experience in handling ships—I am free to say I believe the enterprise a delusion, and there is not a single naval constructor or engineer in the Government employ, who lays any claim to practicability, who would be willing to endorse such a scheme or stake his official reputation upon the success of any scheme requiring the carrying of a vessel, with her cargo, one hundred miles overland, when it is a well-settled rule among them all to prefer to sail a vessel thousands of miles rather than launch her three hundred feet with only her own weight (no cargo) upon the ways. * * *

NATHANIEL MCKAY.

THE ATLANTIC WORKS,
Builders of Iron and Wooden Steamships,
EAST BOSTON, *February* 10, 1881.

Rear-Admiral DANIEL AMMEN, U. S. N.:

DEAR SIR: Replying to yours of the 31st ult., in our opinion the railroad project will never be carried out, for the simple reason that it is not practicable and cannot accomplish the results claimed.

The opinions expressed by Mr. Nath'l McKay, in his article in *The American Ship*, is just *our* opinion regarding the railway.

As to the canal, while we confess ignorance as to details, we have no doubt of the feasibility and the beneficial results of its construction.

Very truly yours,
ATLANTIC WORKS,
ALFRED E. COX, JR.

OFFICE OF DELAMATER IRON WORKS,
NEW YORK, *February* 11, 1881.

DANIEL AMMEN, Esq., *Rear-Admiral U. S. Navy:*

DEAR SIR: Your letter of January 31st was duly received with enclosures. We feel the subject is one that requires more careful investigation than we have been able to give the subject. We have read the articles sent us and of course much other matter relating to this subject. We have never believed that the railroad scheme could be brought to an actual issue. We believe no private capital could be had for such a purpose. As large owners of steam vessels, we should not allow a steamer loaded with cargo to be taken out. Of course we recognize that such a feat can be done, as it is only a question of expense; but the expense would in our minds be entirely prohibitory. We have lately had experience with auxiliary power to sail vessels, fitting out three whalers, all eminently successful. We are led to remark this from a remark in one of your articles relating to sail vessels in canal. We think this subject one to be elaborated on in connection with the canal scheme. We have looked upon the difficulty of building either canal or railroad as so serious as almost to preclude the carrying out of either scheme.

We decidedly favor the canal over the railroad scheme, and it seems to us that here can be but one opinion as to the benefits to the commerce of the world and to that of our own country particularly.

Yours, very resp'y,
C. H. DELAMATER & CO.

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East Wareham, Mass., *February* 10, 1881.

Hon. John Conness:

My Dear Sir: You ask my opinion on Capt. Eads' project for a ship-railway across the Isthmus, as you think I ought to know something on the subject from having had charge of the construction of railways, both marine and others, and not a little experience in canal-building. The first difficulty that presents itself to my mind in the case is the utter impossibility of transporting a loaded sea-going vessel of any considerable size for any distance over land with safety without such an expenditure of time and money as would make the operation perfectly useless for practicable purposes, unless Capt. Eads has discovered some method hitherto unknown and yet unpublished for overcoming well-known physical laws. It is well understood by all ship-builders, ship-owners, and ship-masters that a loaded vessel cannot be hauled out of water with perfect safety on our best-constructed marine railways, even where the speed is so slow as to be hardly discernible; not one vessel in ten of our merchant marine will bear the strain and jar to which they are subjected; hence it is never done, except in cases of the greatest emergency, and it is always an expensive operation. Many instances can be given where unloaded vessels have been seriously injured from being hauled out on a marine railway, and innumerable are the instances where the caulking has been started and seams opened from the inequality of the strain on the different parts of the vessel. I once had a small vessel hauled out on a railway at New Bedford; on being launched the caulking started from one of the seams, making it necessary to beach the vessel to keep her from filling with water; and a similar case happened to me in Chesapeake Bay. It is considered dangerous for a loaded vessel to take ground, even under the most favorable circumstances. A nearly new and well-built vessel belonging to this town was seriously injured last year from grounding while coal-laden at a Boston wharf, though the wharf had been prepared for the reception of such vessels, and all danger from grounding supposed to be provided against. It is inferred by some, from the fact that loaded small boats are carried with safety on railways over inclined planes, that therefore vessels of any size can be transported on a railway, there being merely a difference of cost in the case. In 1851 I had charge of the reconstruction of four of the inclined planes on the Morris Canal, in New Jersey, and know something of their construction and operation. The canal was used as far as was possible, and the inclined planes put in only when great differences of levels were to be overcome in a short distance. This is a vast difference between building a railway for carrying a flat-bottomed canal-boat of 100 tons burden and four feet draught of water and one for a sea-going ship of 2,000 or 3,000 tons burden, with a draught of from 18 feet to 24 feet of water. Certainly no comparison favorable to a ship-railway can be made between them; it might, possibly, suggest the use of inclined planes instead of locks where water was scarce, a great saving of distance made, and vessels to be built expressly for the purpose.

The grading and superstructure for a railway of sufficient strength to sustain the weight of a 3,000-ton ship must cost more to begin with than a canal of equal capacity, and the cost of keeping it in repair would be far greater than that of keeping the canal in repair. It must be perfect in its construction, beyond the possibility of getting out of order from any cause, even a change of temperature. The car or cradle in which the vessel is carried must be so devised as to give the vessel as perfect bearing as in the water; all jars must be provided against; the weight must be so distributed among the car-wheels that they cannot break, as an accident in course of transit from a broken wheel or derailment would be ruinous to the enterprise.

Now, when all this is satisfactorily done, the question of the power required to move this great weight with any considerable speed, and how it shall be applied, presents itself, and we are at once confronted with the fact that ships often stick on the ways in launching, and are moved down grade with difficulty, noticeably in the case of the *Great Eastern* where every emergency was supposed to be provided for by the best engineering talent. Though there has been no positive limit yet put to the weight that can be moved, it must be done at a very slow rate when more than a comparatively few tons are in one body.

These considerations are conclusive to my mind against the economic practicability of Capt. Eads' project, and why the nation should not assist him in its demonstration any more than it should any person who should propose to carry a ship across the Isthmus in a balloon.

Very truly, yours,

A. SAVARY, *Civil Eng'r.*